2023

Roll No. ....

Total No. of Questions : 9]   [Total No. of Printed Pages : 4

(2033)

UG (CBCS) IIIrd Year Annual Examination

3295

B.Sc. PHYSICS

(Elements of Modern Physics)

(DSE-1A)

Paper : PHYS 301 TH

Time : 3 Hours]   [Maximum Marks : 50

Note :– Attempt *five* questions in all, selecting *one* question each from Sections–B, C, D and E. Question No. **1** (Section–A) is compulsory.

Section–A

(Compulsory Question)

1. (i) Why is observation of Compton Effect difficult with visible light ?

   (ii) Why is the wave nature of matter not apparent in our daily observation ?

CA–495   (1)   Turn Over

(iii) What is the importance of normalising a wave function ?

(iv) What are Eigen values and Eigen function ?

(v) Why is that electrons cannot be inside the nucleus ?

(vi) Differentiate between artificial and natural radioactivity.

(vii) Write a short note on 'Thermal Neutrons'. 2×7=14

Section–B

2. (i) Describe the Einstein's theory of photo-electric effect. How does it explain the laws of photoelectric emission ?

(ii) Describe Davisson-Germer experiment for the diffraction of electrons. What role did it play in the verification of de-Broglie hypothesis ? 5,4

3. (i) Explain the various reasons for the acceptance of the Rutherford nuclear atom model.

(ii) Describe Bohr's postulates and derive the formula for Balmer series of hydrogen lines. Calculate the radius of first Bohr orbit. 5,4

CA–495 (2)

Section–C

4. (i) Explain uncertainty principle in Quantum mechanics and by using it calculate binding energy of electron in hydrogen atom.

   (ii) A proton and deuteron have the same kinetic energy. Which one of them will have longer wavelength ?   5,4

5. (i) Derive time dependent Schrödinger equation and from it obtain the time independent Schrödinger equation.

   (ii) Explain expectation value of an operator and the need to define it.   5,4

Section–D

6. (i) What do you mean by a particle in a box ? Obtain expression for energy levels and normalised wave functions for a particle in a box.

   (ii) Calculate the zero point energy of a simple harmonic oscillator.   5,4

7. (i) Derive the semi-empirical mass formula of liquid drop model.

   (ii) What are nuclear forces ? In what respects do they differ from electrostatic and gravitational forces ?   5,4

Section–E

8. (i) What is natural radio-activity ? Explain the terms Half-life and Mean-life and derive a relation for them.

   (ii) Give the origin of neutrino and antineutrino. 5,4

9. (i) What are the different types of nuclear reactions ? Discuss with examples and derive an expression for the Q-value of the reaction.

   (ii) Discuss the role of cadmium control rods in a nuclear reactor. 6,3

CA–495 (4)